

# THE DRIVE TO SUCCEED

## Nine Apple Drives for the II Series

Did you know that nine different Apple-brand, removable-media disk drives work with the Apple II family of computers—five 5¼-inch drives and four 3.5-inch drives? You probably didn't, but it's a fact, and it means dealers and their customers are tearing their hair out trying to determine which drive configurations can work with each of the five different Apple II models. The configuration problem is exacerbated because Apple insisted on giving many of these drives confusingly similar names.

In this article I'll describe each of these nine Apple drives. I'll also show how you can, or cannot, use these drives with each of the Apple II models, from the original Apple II to the brand-new Apple IIGS.

### Cast of Characters

The original drive for the Apple II was the Disk II, first released in 1979. It works with 140K 5¼-inch floppy diskettes and comes with a permanent cable that terminates in a 20-pin rectangular connector. The connector contains two rows of ten pins each and mates with either of the two connectors on the Disk II controller card. The controller card

occupies one of the peripheral expansion slots of a slotted Apple (the II, II Plus, IIe, or IIGS), slot 6 by convention.

Apple no longer manufactures the Disk II but now has four other 5¼-inch drives to replace it: the UniDisk 5.25, Apple 5.25 Drive, the Disk IIc, and the DuoDisk. (The Apple 5.25 Drive is really the same as the UniDisk 5.25, except that the former is light gray.) The drive mechanism in each of these drives is functionally equivalent to that of the Disk II, so all of Apple's 5¼-inch drives can read from and write to the same diskettes.

The DuoDisk contains two drives in one box, and the UniDisk 5.25, Apple 5.25 Drive, and Disk IIc are one-drive devices. All of these drives have the same type of connector cable, one that terminates in a D-shaped, 19-pin, male DB-19 connector. This connector mates with the external drive port on the back of the Apple IIc or the Apple IIGS but not with the connectors on the Disk II controller card. (Adapter cables are available—the Adapt-A-Disk from Computer Accents, for instance, is \$19.95.) To enable you to

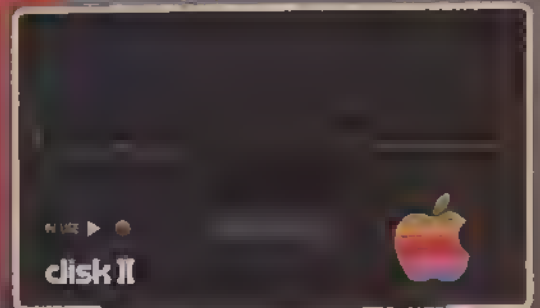
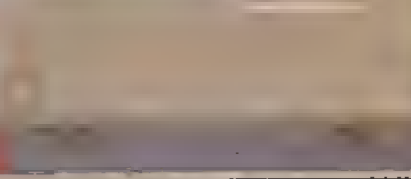
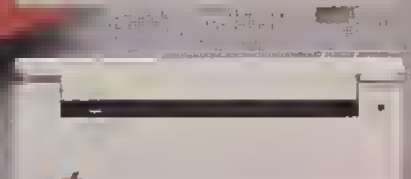
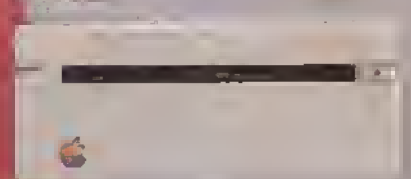
use these drives with a slotted Apple II, Apple has another controller card, the DuoDisk Controller Card (now called the Apple 5.25 Drive Controller), with one female DB-19 connector.

Even though the Apple 5.25 Drive Controller has only one connector, you can use two (but no more than two) UniDisk 5.25 or Apple 5.25 drives with it by connecting the second drive to a similar connector on the back of the first drive. This method of connecting multiple drives is called daisy-chaining and is now Apple's "official" technique for attaching multiple drives to a system. Since a DuoDisk contains two drives, it does not have a daisy-chain connector; nor does the Disk IIc, since you can add only one 5¼-inch drive to the external drive port of the IIc. (You can, however, chain more than one 3.5-inch drive to this computer.)

In 1985, Apple started selling a 3.5-inch drive for the Apple II called the UniDisk 3.5. This intelligent device, which contains a 65C02 microprocessor and a program in ROM for controlling disk data transfers, uses double-sided 800K hard-shelled disks and works with any Apple II model (except older Apple IIc systems). The UniDisk 3.5 cable has the same DB-19 connector as does the cable for the UniDisk 5.25 and the DuoDisk, but the drive works only with its own special controller card.

When Apple announced the IIGS last September, it unveiled another 3.5-inch drive, the Apple 3.5 Drive. It works with the same 800K disks as the UniDisk 3.5 does but lacks the built-in intelligence of the UniDisk 3.5, so it doesn't work with the UniDisk 3.5 controller card; in fact, the drive works on the IIGS and the Macintosh only. The main advantage of using an Apple 3.5 Drive instead of a UniDisk 3.5 on the IIGS is that it operates slightly faster.

The other two Apple-brand 3.5-inch drives that you can get to work



with some members of the II family are the standard 400K and 800K external drives for the Macintosh. To use them, you must have a Universal Disk Controller (UDC) from Central Point Software (more on the UDC below). The UDC also works with all other Apple drives (except the DuoDisk). The 800K Macintosh drive you can use with the UDC is UniDisk-compatible, but the 400K Mac drive is not. Since 400K drives are now obsolete on the Macintosh, however, you can probably get them quite inexpensively if you're a bargain hunter.

Now that you have a summary of the many types of disk drives and controller cards available to Apple II owners, let's move on to an examination of which drives work with the various Apple II models—complete with some useful configuration tips.

### Apple IIc

The Apple IIc is the easiest system to configure for drives because it has no expansion slots. It comes with one internal 5.25-inch drive and has an external drive port to which you can daisy-chain other types of drives.

The four types of drives you can plug into the IIc drive port are the Disk IIc, UniDisk 5.25, Apple 5.25 Drive, and UniDisk 3.5. The new Apple 3.5 Drive, the DuoDisk, and Macintosh drives do not work with the IIc. You can use the old Disk II but only if you have an adapter cable, such as the Adapt-A-Disk mentioned above.

The most popular add-on-drive setup for IIc users is simply a single 5.25-inch drive. In fact, you can't add more than one 5¼-inch drive to the external drive port—that's why you can't use the DuoDisk on the IIc.

If you want to use one or two UniDisk 3.5 drives with the IIc (the power supply may struggle if you try using more than two), you can daisy-chain them to the drive port. In order to use a 5¼-inch drive as well, that drive must be chained to the final UniDisk 3.5. Chaining a 3.5-inch drive to a 5¼-inch drive does not work.

The internal drive on the IIc works as if it were plugged into slot 6/drive 1. An external 5¼-inch drive, be it connected directly to the drive port or to the daisy-chain connector of a UniDisk 3.5, is the slot 6/drive 2 device. The first UniDisk 3.5 is the slot 5/drive 1 device, and

the second is the slot 5/drive 2 device; thus, you can boot from an external UniDisk 3.5 with a PR#5 command. You cannot, however, boot from an external 5¼-inch drive.

You can use the UniDisk 3.5 with the IIc only if your IIc has the new 32K 3.5 ROM. If you have an older Apple IIc (before serial number F6051GEA24000), have your dealer install the ROM upgrade first. To check whether you already have the upgrade, enter Applesoft BASIC and enter the following command: PRINT PEEK(64447). If the result is 0, you do have the upgrade.

### Apple II, II Plus, and IIe

Unlike the Apple IIc, the II, II Plus, and IIe have no built-in drive port, so you must put an appropriate disk-controller card into a slot before you can use a drive. All three Apple-brand controller cards work with these systems; the one to use depends on which drives you are installing:

- You can connect two Disk II drives to a Disk II controller card, one to each connector on the card.
- You can connect one UniDisk 5.25, Disk IIc, or DuoDisk to an Apple 5.25 Drive Controller. If you connect a UniDisk 5.25 or an Apple 5.25 Drive, you can add another one, or a Disk IIc, by connecting it to the first drive's daisy-chain connector. You cannot connect a 3.5-inch drive to the Apple 5.25 Drive Controller, though, or daisy-chain one to a UniDisk 5.25 or an Apple 5.25 Drive.
- You can connect one UniDisk 3.5 to the UniDisk 3.5 controller card or daisy-chain one other UniDisk 3.5 drive. Don't add a third UniDisk 3.5, because neither ProDOS 1.1.1 nor ProDOS 8 can recognize it. The UniDisk 3.5 controller does not work properly with the Apple 3.5 Drive or with any 5¼-inch drive.

To date, Apple has not developed a controller card that works with both 5¼-inch and 3.5-inch drives. Such a card would be welcome because it would free up an extra slot. A third-party developer, Central Point Software, has come to the rescue, though, with the Universal Disk Controller. The UDC is the most interesting new peripheral device to come along in quite some time.

The UDC has two drive connectors to which you can connect almost any type of disk drive: the Disk II, UniDisk 5.25, UniDisk 3.5, and Mac-

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intosh 400K and 800K external (but not the DuoDisk). You can also daisy-chain multiple UniDisk 3.5 drives to one of its connectors (in this case, the other connector can have only one drive connected to it). The UDC works with the Apple 3.5 Drive too, but the UDC revision I tested disabled the drive's disk-eject button, so I had to eject disks with the end of a paper clip. Central Point is aware of this problem and expects to eliminate it by the time you read this article.

One common drive configuration for UDC users is one 5¼-inch drive and one 3.5-inch drive. In this situation, you should connect the 5¼-inch drive to the UDC's drive 1 connector and the 3.5-inch drive to the drive 2 connector. If you reverse the drives, you won't be able to boot DOS 3.3 from the 5¼-inch disk in drive 2. If you use ProDOS exclusively, the configuration doesn't

matter, because ProDOS boots properly from either drive. (You can boot from drive 2 by removing the diskette from drive 1 and entering a PR#n command [n = the number of the slot in which your disk-controller card resides].)

If you're still using ProDOS 1.1.1, you shouldn't attach more than two drives to the UDC, because that's all this version of ProDOS allows. The new ProDOS 8 (introduced with the IIGS), however, works properly with the first four drives you add to the card, as long as the card is in slot 5—it treats the third and fourth drives as slot 2 drives.

#### Apple IIGS

The IIGS has slots like the IIe and built-in peripheral ports like the IIc. To select whether a port, or its corresponding slot, is active, you use the Slots command in the Control Panel desk accessory. You can call up the desk-accessory menu any time by

pressing Control/open-apple/Esc.

One of the built-in ports, corresponding to slot 5, is a disk-drive port called the SmartPort; it is designed to handle 3.5-inch disk drives and any intelligent peripherals that use the data-exchange protocol and electrical specifications it defines. The SmartPort connector, located at the back of the GS, is a DB-19 type.

Another built-in port, corresponding to slot 6, is the 5¼-inch Drive Port. It actually shares its physical connector with the SmartPort, which doesn't cause problems, because 5¼-inch drives can be daisy-chained to SmartPort devices.

Most users of the IIGS will daisy-chain drives to the SmartPort instead of using plug-in controller cards. The five types of drives you can chain to the SmartPort are the UniDisk 3.5, the UniDisk 5.25, the Apple 5.25 Drive, the DuoDisk, and the Apple 3.5 Drive. It is important to understand, however, that you can't chain these drives in just any order. If you are using Apple 3.5 Drives, they must appear at the beginning of the chain, before any UniDisk 3.5 drives or 5¼-inch drives. You can use up to two of these types of drives.

At the very end of the chain come the 5¼-inch drives: up to two UniDisk 5.25 drives or one DuoDisk (which is equivalent to two UniDisk 5.25 drives). You must be aware of one caveat relating to the DuoDisk, however: Because of a hardware problem in the drive, you cannot daisy-chain a DuoDisk with a serial number below 433754. Apple has published a technical note describing a hardware fix, so track it down if you want to use an old DuoDisk with the IIGS.

Between the Apple 3.5 Drives at the beginning of the chain and the UniDisk 5.25 drives at the end of the chain can come any UniDisk 3.5 drives. The number of UniDisk 3.5 drives is limited by the capacity of the IIGS power supply. Apple recommends that you connect no more than four drives to the SmartPort (including any Apple 3.5 Drives and 5¼-inch drives), although I've tried it with six with no ill effects.

Keep in mind that any other arrangement of drives does not work: it's always Apple 3.5 Drives followed by UniDisk 3.5 drives followed by 5¼-inch drives.

## NON-APPLE DISK DRIVES

In addition to the nine types of floppy-disk drives from Apple, you can find many Apple-compatible drives sold by mail-order businesses and computer stores, usually at substantially lower prices. They fall into four main categories:

- drives compatible with the 140K 5¼-inch Disk II or UniDisk 5.25 drives
- drives compatible with the 400K

*Three of the available Apple-compatible drives are the ADD-514, ADD-12, and ADD-11c from Jameco Electronics.*



3.5-inch external drives of the original Macintosh

- drives compatible with the 800K 3.5-inch external drives of the Macintosh Plus and Macintosh 512K Enhanced
- drives that use nonstandard recording formats and special controller cards

Third-party 5¼-inch drives are available in full-height (Disk II size) or half-height (UniDisk 5.25 size) models. Several computer stores tell me that drives made by Shugart are more reliable than those made by Alps and that half-height drives tend to be more reliable than full-height drives, but these are only general guidelines.

The 400K Macintosh-compatible 3.5-inch drives can be had for bargain prices, now that Mac users are ignoring them and buying the new 800K drives instead. You can use them on the Apple II with the Universal Disk Controller (UDC), but you should probably avoid them because you won't be able to swap disks with people who are using standard Apple equipment. The 800K 3.5-inch drives also work with the UDC, and the disks they format are readable by the UniDisk 3.5 and Apple 3.5 drives, so you should buy them instead.

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The standard operating system for the IIGS, ProDOS 8, requires that disk devices be linked to traditional slot/drive combinations with no more than two drives per slot. How, then, does it deal with the possibility that more than two drives may be chained to the slot 5 SmartPort?

The way ProDOS 8 assigns slot/drive combinations to SmartPort disk drives is a bit unusual. In most situations, the first four 3.5-inch drives are considered to be the slot 5/drive 1, slot 5/drive 2, slot 2/drive 1, and slot 2/drive 2 devices. The two 5 1/4-inch drives linked to the SmartPort correspond to slot 6/drive 1 and slot 6/drive 2; i.e., connecting them to the end of the SmartPort chain is the same as connecting them to a controller card in slot 6.

Using the IIGS Control Panel to define a system RAMdisk, however, scrambles the slot/drive assignments slightly. The first 3.5-inch drive is still the slot 5/drive 1 device, but the RAMdisk is assigned as the slot 5/drive 2 device. The next two 3.5-inch drives "occupy" slot 2/drive 1 and slot 2/drive 2. ProDOS 8 does not recognize any other 3.5-inch drives.

Happily, all this slot/drive confusion will be eliminated when ProDOS 16 for the IIGS comes out later this year. ProDOS 16 will not require slot/drive assignments at all and will work with any number of disk devices without difficulty.

If you want, you can also use either of the two standard Apple 5 1/4-inch disk-controller cards on the IIGS. The 3.5-inch disk controller does not work with the GS, however. If you do put a controller card into slot 5 or 6, keep in mind that you won't be able to use the SmartPort or the Drive Port, respectively.

The latest revision of the Universal Disk Controller works well on the IIGS, but earlier ones did not. Central Point Software has a reasonable \$15 upgrade offer for those with old UDCs who are upgrading from a IIe to a IIGS.

A nice feature of the IIGS is that you can use the Control Panel to tell it the slot of the drive to boot from—the Startup Slot. The default is Scan, which means the GS boots from the first drive it encounters in a search beginning in slot 7 and moving down to slot 1 (the IIe uses the same method). It considers only the first drive in each slot or port, however,

so you can't boot from a secondary drive. If you prefer, you can tell the GS to boot from a given slot—you specify slot 5 to boot from the first 3.5-inch drive connected to the SmartPort, for example.

### More to Come?

Congratulations, you're now a certified Apple II disk-drive expert—for now, at least! If past behavior is any indication, Apple is sure to have more types of drives up its sleeve, so you'll have to work hard to maintain your status. Until then, the cheat sheet in the table that accompanies this article should help you keep your disk-drive facts straight. +

*Gary Little is the author of Point-to-Point, Pinpoint's new telecommunications program for the IIe, IIc, and IIGS.*

## PRODUCT INFORMATION

### Universal Disk Controller

Central Point Software, Inc.

9700 SW Capitol Highway,

Suite 100

Portland, OR 97219

(503) 244-5782

List Price: \$90

**Requires:** any Apple II disk drive except the DuoDisk, Macintosh 400K external drive, or Macintosh 800K external drive

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**DuoDisk, UniDisk, Disk IIc, Apple 5.25 Drive, Apple 5.25 Drive Controller, UniDisk 3.5, UniDisk 3.5 Controller Card, Apple 3.5 Drive, and Macintosh 800K Drive**

Apple Computer, Inc.  
20525 Mariani Avenue  
Cupertino, CA 95014  
(408) 996-1010

**List Price:** DuoDisk (with Apple IIe accessory kit), \$599; UniDisk, \$299; Disk IIc, \$299; Apple 5.25 Drive, \$299; Apple 5.25 Drive Controller, \$69; UniDisk 3.5, \$399; UniDisk 3.5 Controller Card, \$69; Apple 3.5 Drive, \$399; Macintosh 800K Drive, \$399

**Requires:** see table

### Adapt-A-Disk

Computer Accents, Inc.

P.O. Box 5905

Kingwood, TX 77325

(713) 664-9727

List Price: \$19.95

**Requires:** Apple IIc or IIGS, Disk II

CIRCLE 380 ON READER SERVICE CARD



# DISK DRIVES FOR THE APPLE II SERIES

**WORKS ON  
II, II PLUS, IIc**

**WORKS ON  
IIc**

**IIc  
WORKS WITH  
SMARTPORT**

**IIc  
WORKS WITH  
CARD**

**DAISY-CHAIN  
CONNECTOR**

## UNIDISK 3.5

**YES**

Requires Apple 3.5  
drive controller card or  
the UDC

**YES**

**YES**

**YES**

Requires the UDC

**YES**

## APPLE 3.5 DRIVE

**YES**

Requires the UDC

**NO**

**YES**

**YES**

Requires the UDC

**YES**

## MACINTOSH 4DDK

**YES**

Requires the UDC

**NO**

**NO**

**YES**

Requires the UDC

**NO**

## MACINTOSH 800K

**YES**

Requires the UDC

**NO**

**NO**

**YES**

Requires the UDC

**NO**

## DISK II

**YES**

Requires Disk II  
controller card or the  
Universal Disk  
Controller (UDC)

**YES**

Requires DB-19  
adapter cable

**YES**

Requires DB-19  
adapter cable

**YES**

Requires Disk II  
controller card or the  
Universal Disk  
Controller

**NO**

## APPLE 5.25 DRIVE

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**YES**

**YES**

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**YES**

## UNIDISK 5.25

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**YES**

**YES**

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**YES**

## DISK IIc

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**YES**

**YES**

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**NO**

## DUODISK

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**NO**

**YES**

**YES**

Requires Apple 5.25  
drive controller card or  
the UDC

**NO**

